INTERNATIONAL STANDARD

ISO 21326

First edition
2019-06

Textiles — Test methods for determining the efficiency of products against house dust mite

Textiles — Méthodes d'essai pour déterminer l'efficacité des produits contre les acariens

Reference number
ISO 21326:2019(E)

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Published in Switzerland

Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 38, *Textiles*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The World Health Organization's (WHO) statement on the correlation of house dust mite to asthma and other allergic disorders resulted in the increased number of textile products treated against house dust mite available to the consumer.

However, the testing method to evaluate the efficacy against house dust mite of textiles has not been standardized to date. This has caused confusion among consumers because of various testing methods and results.

The purpose of this test method is to standardize the testing method of efficacy of products against house dust mite in textiles.

Textiles — Test methods for determining the efficiency of products against house dust mite

1 Scope

This document specifies test methods for efficiency of chemically or physically treated textile products against house dust mites.

For the products treated by chemicals against house dust mites, the test methods specified in a) to c) are applied. For the physically treated products, the test method specified in d) is applied.

a) Repelling method by using Petri dish

   This method is applied to carpet, bedding surface fabric, bed sheeting, bed covering and blanket.

b) Repelling method by using glass tube (Methods A and B)

   This method is applied to wadding (bedding, etc.) with a fibre content of cotton, wool or synthetic fibre, feathers/down.

c) Proliferation method by using Petri dish (Method A) and using vial (Method B)

   Method A is applied to carpet, bedding surface fabric, bed sheeting, bed covering and blanket. Method B is applied to wadding.

d) Penetration method

   This method is applicable to the outer fabric of a futon, bed sheeting and bed covering. However, this method is not applicable to the multiple component non-woven fabrics and fibre products with the high stretch properties such as jersey fabrics.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 105-F02, *Textiles — Tests for colour fastness — Part F02: Specification for cotton and viscose adjacent fabrics*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 9237, *Textiles — Determination of the permeability of fabrics to air*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
house dust mite
universal dominant species belonging to Pyroglyphidae, observed in or on floor surfaces, carpets and bedding with house dust as example

3.2
efficiency of repellency
efficiency of the treatment in repelling house dust mites

3.3
rate of repellency
ratio of the number of live mites in treated material against the number of live mites in untreated material

Note 1 to entry: The rate of repellency is expressed in percentage (%) and represents the efficacy of repellency of treated materials.

3.4
rate of suppression of house dust mite reproduction
ratio of the number of live mites in treated material against the number of live mites in untreated material tested by the proliferation method

Note 1 to entry: The rate of suppression for reproduction of house dust mite is expressed in percentage (%) and represents the degree of population control of treated materials.

3.5
culture medium
diet for breeding house dust mite

3.6
mite medium
mix of diet and live house dust mite

3.7
live mite
mites which react when stimulated from the outside

Note 1 to entry: It includes all of larva, nymph (protonymph and tritonymph) and adult mites but exclude eggs.

3.8
population density
degree of live mites in a mite medium

Note 1 to entry: The number of live mites in 1 g of the mite medium.

3.9
quiescent period
period in the stage in which activity of mites almost stops and is observed in the latter half of each development period of a larva, protonymph and tritonymph

4 Principle

4.1 Repelling method by using Petri-dish

The small Petri dish is placed in the centre position of the large Petri dish. The specimen or the reference fabric is placed in the small dish with the culture medium. The mite medium with 10 000 mites is spread in the large Petri dish for the mites to migrate to the small dish. After the designated time has elapsed, the number of live mites that have intruded into the small Petri dish where the test specimen and culture medium have been placed is counted. The efficiency of repellency is calculated by comparing the numbers of live mites for the reference test.

4.2 Repelling method by using glass tube, Method A and Method B

The specimen or the reference fabric is placed in one end of the glass tube in the following order: stuffing, culture medium and the adhesive tape at the end. The mite medium with 10 000 mites is placed at the opposite end of the glass tube and the mites migrate in the glass tube all the way. After the designated time has elapsed, the number of live mites in the stuffing, the culture medium and adhesive tape which are passing through the specimen or reference are counted. The efficiency of repellency is calculated by comparing the numbers of live mites for the reference test.

Glass tube Method A is a test method for wadding sample. Glass tube Method B is a test method for down and feather sample. For Method B only, use a stainless steel mesh disc to fix the position of the specimen in the glass tube.

4.3 Proliferation method by using Petri-dish Method A and using vial Method B

Mite medium with 50 to 80 live mites per 0,1 g is placed on the specimen in a Petri dish or vial. After the designated time has elapsed, the numbers of live mites on the Petri dish or vial, the specimen and the mite medium are counted and summed. The suppression effect of house dust mite reproduction is calculated by comparing the numbers of live mites for the reference test.

The Petri dish Method A is for the carpet samples, etc. and the vial Method B is for wadding samples.

4.4 Penetration method

The specimen or the reference is placed at the upper end of the glass tube and wrapped by plastic wrap tightly. The mite medium with 10 000 mites are placed at the bottom of the glass tube on the paper filter which is tightly sealed. After the designated time has elapsed, the number of the mite on the specimen or the reference which is passing through is counted through the plastic wrap. Check the efficiency for prevention by comparing the number of house dust mite passing through the fabric in the specimens and the reference.

5 Preparation of test

5.1 Reagents

The reagents shall be as follows.

5.1.1 Water, grade 3 according to ISO 3696.

5.1.2 Dried yeast, refined beer yeast, dried, mashed and filtered by a sieve.

5.1.3 Saturated sodium chloride solution, 392 g sodium chloride (NaCl) dissolved in 1 000 ml of water.

5.1.4 Nonionic surfactant solution, 0,1 g of nonionic surfactant [Polyoxyethylene sorbitan monooleate (Polysorbate 80) (CAS Number 9005-65-6)] dissolved in 100 ml of water.

5.1.5 Colouring liquid.

Dissolve,

— 6,0 g of crystal violet ($C_{25}H_{30}ClN_3 \cdot 9H_2O$)

or

— 0,6 g of methylene blue ($C_{16}H_{18}N_3S \cdot Cl \cdot 3H_2O$)

in ethanol (C_2H_5OH) of 100 ml,

then,

— dilute with water to make 1 000 ml.

5.2 Apparatus

5.2.1 Oven, capable of maintaining a temperature of 70 °C ± 2 °C.

5.2.2 Incubator (or incubation room), capable of maintaining a temperature of 25 °C ± 2 °C in dark conditions.

5.2.3 Erlenmeyer flask, with a nominal volume of 50 ml.

5.2.4 Beaker, with a nominal volume of 50 ml and 100 ml.

5.2.5 Large Petri dish, made of glass, with an internal diameter of approximately 90 mm and an internal height of approximately 20 mm.

5.2.6 Small Petri dish, made of glass, with an external diameter of approximately 45 mm and an internal height of approximately 15 mm.

5.2.7 Glass tube A, hard-coated glass type with an external diameter of 22,0 mm ± 0,6 mm (wall thickness 1,2 mm ± 0,2 mm) and a length of approximately 100 mm.

5.2.8 Glass tube B, hard-coated glass type with an external diameter of 40,0 mm ± 0,6 mm (wall thickness 2,0 mm ± 0,2 mm) and a length of approximately 55 mm.

5.2.9 Rubber band, approximately 70,0 mm lay-flat length and approximately 15,0 mm width.

5.2.10 Vial, made of glass with an external diameter of approximately 30 mm, an internal height of approximately 63 mm and a volume of approximately 30 ml.

5.2.11 Hot-melt adhesive, with appropriate adhesive strength and no effect to mites.

5.2.12 Filter paper, used for counting mites with a diameter of 70 mm or 90 mm and a grid pattern of 5 mm to 10 mm in square.

5.2.13 Adhesive tape, with appropriate adhesive strength and no effect to mites.

5.2.14 Sticky sheet, with an adhesive strength with the ability to anchor mites that may escape.

5.2.15 High-density fabric, with air permeability of 1 $cm^3/cm^2 \cdot s$ to 10 $cm^3/cm^2 \cdot s$ as specified in ISO 9237 with a fibre content of 100 % cotton.

5.2.16 Standard woven fabric, 100 % cotton fabric used for the reference of the colour fastness test specified in ISO 105-F02.

5.2.17 Airtight container, made of polypropylene used for food preservation.

5.2.18 Powder diet, for small laboratory animals (mouse, rat, hamster, etc.) and used for breeding mites.

5.2.19 Balance, with a minimum indication of 1 mg with a scale in graduations of 0,1 mg.

5.2.20 Stereoscopic microscope, with an epi-illumination device with 20 × magnification.

5.2.21 Test sieve, as specified in ISO 3310-1.

The sieve opening shall be as follows.

a) The mesh opening size is the range of 500 µm to 700 µm, used in Annex B.

b) The mesh opening size is 300 µm, used in Annex A.

5.2.22 Stainless mesh disk, a circular-shaped wire mesh of approximately 20 mm diameter to fit the glass tube A (5.2.7), used for both ends of the specimen to keep thickness 20 mm ± 2mm for feather and down sample in Annex D.

5.2.23 Suction unit, capable of performing suction filtration with an aspirator (or a suction pump) with a Buechner funnel attached to a vacuum flask. The bypass can be included for adjusting suction force if necessary.

5.2.24 Counter, capable of counting from 0 to 9 999.

5.2.25 Plastic wrap, as used for food preservation made of polyethylene or polypropylene.

5.2.26 Stuffing, staple fibre such as 100 % polyester with a fineness of 5 dtex to 8 dtex and fibre length 51 mm to 75 mm for counting the number of mites in Annex D.

6 Reference sample

For all test methods, prepare the reference specimens. Reference specimens are untreated products similar to the test sample. If it is not available, use the same category of the products with the same structure to the testing sample.

7 Preparation of mite medium

The mite medium used for the test shall be prepared in accordance with Annex A.

After the colonization procedure specified in Annex A, just before the test, prepare the mite medium for inoculation using the following procedure.

a) Take 0,025 g or 0,050 g of the mite medium which has been well stirred.

b) Count the number of live mites in the mite medium according to B.2.1 or B.2.2. If the amount of mite medium used is 0,025 g, count the number of each live mites 8 times. If the amount of mite medium used is 0,05 g, count the number of each live mites 4 times.

c) Calculate the number of live mites in 1 g of the mite medium and the mass of mite medium with 10 000 mites for inoculation according to Formula (1):

$$q = \frac{10\ 000}{Nm} \tag{1}$$

where

q is the mass of the mite medium (g) with 10 000 live mites;

Nm is the number of live mites in 1 g of the mite medium.

d) Calculate the coefficient of variation values by using Formula (2) for the judgment of test effectiveness.

$$Cv = \frac{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \Big/ (n-1)}}{\bar{x}} \times 100 \quad (2)$$

where

Cv is the coefficient of variation (C_V %);

$x_1, x_2, \ldots x_n$ is the counting value of live mites in 0,025 g (or 0,050 g) of mite medium;

$\bar{x}$ is the average of live mites in 0,025 g (or 0,050 g) of mite medium;

n is the number of times of counting of mite medium, n = 8 (or n = 4).

e) Prepare the quantity of the mite medium with 10 000 live mites for inoculation in Annexes C, D and F.

f) From the measured value taken using step b), mix the mite medium including live mites with the culture medium without mites so that the number of live mites is between 50 and 80 in 0,1 g of the medium. This is used for inoculation in Annex E.

8 Test conditions

8.1 Condition for work area

Temperature 23 °C ± 5 °C and relative humidity (55 ± 15) % is used for the work area.

8.2 Testing conditions

The culture medium for breeding and all testing apparatus assembly are placed in the airtight container (5.2.17) with the saturated sodium chloride solution (5.1.3) with a concentration of 10 % to control relative humidity at (75 ± 5) %. The containers are then placed in the incubator at the temperature of 25 °C ± 2 °C.

9 Test methods

9.1 Repelling method by using Petri dish

The test is carried out according to Annex C.

9.2 Repelling method by using glass tube

The tests are carried out according to Annex D.

9.3 Proliferation method by using Petri dish (Method A) and using vial (Method B)

The tests are carried out according to Annex E.

9.4 Penetration method

The test is carried out according to Annex F.